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ABSTRACT

As part of the Educational Resource and Outcome Project, this study explored the budgetary threshold needed by poor and low-income school districts to improve scholastic outcomes and the optimal range of school district expenditures; the best composition of financial resources for improved scholastic outcomes; and economics phenomena that could mitigate the districts' operational costs. Two empirical models were constructed: (1) a descriptive model of 28 logistic equations portraying quantitative relationships between resources utilized and educational outcomes; and (2) a prescriptive model of resource allocation constructed through a goal programming technique. Over 400 finance and account items from 200 school districts in 8 counties in New York were used, with 4 case studies for diverse school districts. Results suggest that a budgetary threshold of $4,000.00 per student could produce improved scholastic outcomes. However, an increase of 67% in per student expense was estimated to increase outcomes by only 15%, making it difficult to justify a budget configuration over $6,685.00 per student measured in 1985 dollars. Ramifications for state educational policy are discussed. Table A lists the financial expenditure categories. (SLD)

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The Educational Resource and Outcome Project*
SCHOOL DISTRICT RESOURCES AND TEST RESULTS
N.Y.S. Education Department Project No. 292
AN EXECUTIVE SUMMARY

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I. INTRODUCTION

The rising cost of rendering educational services along with the private sector's demand for an improved human capital, and the concurrent decline of pupils' test scores have intensified the debate concerning the relationships between educational outcomes and expenditures on public education services. As of late, this debate has been transformed into a public demand for improved educational services through the adoption of "effective" teaching methods and efficient resource utilization policies.

Consequently, various commissions were established to investigate the educational problems and their recommendations were widely reported in the printed media. In essence these recommendations call upon the public educational sector to implement policies such as:

- stiffer diploma requirements
- tougher academic standards
- improved teachers' qualifications
- improved guidance and counseling services
- longer hours in school.

While these recommendations are designed to improve the quality of education, they barely address the financial aspects of rendering such "new and improved" educational services. Also, the commissions' reports contain vague and discursive discussions about the influence of socioeconomic and community attributes (which are beyond the district's control) upon the scholastic outcomes "produced" by the schools. Finally, the said recommendations seem to contradict the New York State egalitarian educational philosophy inasmuch as property poor districts may not have the necessary resources to realize these recommendations under the current resource allocation practices.

Because the relationships between the above issues are not intuitively obvious, it was felt that the school administrators are in need of a statewide analytical model showing the relationships between school resources and scholastic achievement that could be used by the administrators as an operational theory or realistic metaphor, while resolving their performance problems.

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Hence, proven analytical methods found in the educational economic and management science literature were utilized to ascertain the quantitative relationships between scholastic outcomes and school resources utilized while realizing these outcomes. This quantitative analysis was based on the premise that the scholastic performance of various types of school districts can be enhanced at a reasonable cost, without meddling with the districts' current organizational structure and their prevailing educational processes.

II. THE RESEARCH PROBLEMS

Given the above issues, along with the fact that the school districts are semi-autonomous municipal entities empowered with the means to finance their services, the avowed intent of this study was to explore the:

- o budgetary threshold needed by property poor and low income districts in order to improve their scholastic outcomes, along with the optimal range of total expenditures (per pupil) which would lead to the realization of these enhanced outcomes;
- o best composition of financial resources (by category) that would lead to a situation whereby a given type of district would produce an improved level of scholastic outcomes, while considering the pupil, school and community attributes of the district;
- o economics phenomenon that can be exploited for the purpose of mitigating the districts' operational costs.

III. THE APPROACH

The research problems were analyzed through the application of a hybrid approach composed of both economic and management science paradigms. Thus, two empirical models were constructed. The first model is "descriptive" in nature composed of 28 logistic equations. Each equation portrays the quantitative relationships between the educational resources utilized by the school districts and the corresponding scholastic outcome "produced" by these educational entities. Resources in this instance include both financial resources controlled by the schools and community attributes which are beyond the control of the districts. The outcomes in this study were measured in terms of the school's performance on various state-administered tests.

The second model is "prescriptive" in nature, and as such it was used to allocate the resources available within the districts so as to achieve the desired level of scholastic outcomes (to be "produced" by the districts). A goal programming technique, along with the coefficients of the logistic equations, were used to construct this model. To demonstrate the applicability of this model to the problem of resource allocation within school districts, four scenarios were formulated and solutions for these scenarios were derived. Each scenario represented a particular type of school district.

To construct the data base for this research endeavor, over 400 school finance and account items along with a score of scholastic outcome

indicators and numerous nonfinancial variables were culled from various state sources for 200 school districts located in eight counties of the State of New York.

According to this approach, school districts were perceived to be "semi-autonomous firms" whose single mission is to provide free educational services to their respective children. These services are said to be "publicly induced collective goods" inasmuch as these services are financed by one segment of society (taxpayer) but benefit another segment of society. Since the financial revenues of the districts are not derived directly from services they produce, they are said to be "nonmarket firms", and as such, these firms lack the incentive of utilizing their resources efficaciously.

To test the applicability of this approach to the problem of efficacious financial resource allocation within school districts, a diversity of school districts were analyzed, namely:

- Case 1 represents a large (municipal) and property poor district whose average income per return is said to be $17,725 - containing about 8,000 pupils. Its most recent budget (1985) was said to be about $3,100 per pupil.
- Case 2 represents a large suburban school containing approximately 7,000 pupils whose average income per return is $22,700 which is below the statewide average. (Budget = $4,682)
- Case 3 represents a school district whose average income per return ($29,000) is equal to the statewide average and its enrollment is about 1,950 pupils. (Budget = $6,757)
- Case 4 represents a school district whose income per return ($35,000) is said to be above the statewide average and its enrollment is approximately 2,320 pupils. (Budget = $6,631)

These four cases were also used while exploring the budgetary threshold and its range, required to enhance the probability that these types of schools will "produce" more pupils who pass state-administered tests.

IV. THE FINDINGS

In using this methodology, solutions regarding the attainability of the enhancement in the test results and the corresponding distribution of the budget needed to realize these outcomes were derived for each of the above cases through the application of the said model. The findings of this study are discussed below in terms of issues such as:

- the budgetary threshold, its range and outcomes;
- the distribution of funds over the various financial categories and their inferences;
- the exploitation of externalities and economies of scale.

A. Budgetary Threshold, Its Range and Outcomes

Although certain socioeconomic and community attributes do influence the educational outcomes, the findings suggest that property poor and low income districts with a budgetary threshold of $4,000 per pupil can "produce" an improved set of scholastic outcomes. It was shown that this budget amount will allow such districts to realize outcomes which are 5-10% above their 1985 performance. The results also suggest that a budget configuration of $6,685 per pupil will enable these schools to perform at a performance level which is 15% above the 1985 level. In other words, an increase of 67% in the per pupil expense was estimated to increase the test results by 15% only. Therefore, a budget configuration above $6,685 per pupil, measured in 1985 dollars, seems to be difficult to justify.

The discrepancy between the percentage increase of expenditure and the corresponding percent change in the scholastic achievement concurs with the elasticity analysis results. This analysis suggests that the financial variables' influence upon the outcome variables is smaller than the impact of the nonfinancial attributes. The ramification of these results is that property-poor districts have to compensate for their deficiency in nonfinancial attributes (which influence the scholastic outcomes), by increasing their expenditure per pupil at a rate which is higher than the desired rate of improvement in performance which they wish to achieve.

B. Distribution of Funds

A comparison of the goal programming solutions to the 1985 schools' allotment figures reveals a vastly different distribution pattern over the twenty (20) financial categories. For expository purposes the names of these categories are reproduced below:

Table A
LIST OF FINANCIAL EXPENDITURE CATEGORIES

Category Code	Financial Category Name
Y(1)	Total (Chief) School Administration
Y(2)	Total Instr./Improvement & Research
Y(3)	Teachers Salaries Total - INSTRUCTION
Y(4)	Non-Instructional Salaries "
Y(5)	Equipment/Supply Text Books "
Y(6)	BOCES/Contractual/Tuition "
Y(7)	Total Instruction (Teaching) "
Y(8)	Instructional Salaries --- MEDIA
Y(9)	Equipment/Supply "
Y(10)	BOCES/Contractual "
Y(11)	Total Instructional Media "
Y(12)	Total Pupil Services
Y(13)	Total Cocurricular
Y(14)	Total Interscholastic Athletic
Y(15)	Total Cocurric./Athletic
Y(16)	Total Community Recreation
Y(17)	Total Youth Programs
Y(18)	Total of Y(16) + Y(17)
Y(19)	Total Emply.Benefit
Y(20)	Sum of Operat./Maint./Transp.

For instance, the goal programming solution relative to financial category 1 (total school admin.) is much higher than the 1985 allotment for all four cases. However, the value of this solution tends to decrease as the wealth of the district increases. On the other hand, the 1985 allotment for financial category 2 is twice as large as the goal programming solution for all four cases mentioned earlier. The implication of these findings is that much greater effort must be devoted by management to assure the realization of the targeted outcomes, whereas less money should be devoted to other administrative functions associated with financial category no. 2.

A comparison of the goal programming solutions to the 1985 allotments relative to category 3 will reveal similar discrepancies. Under a lean budget configuration, the goal programming solution calls for the entire allocation of instructional funds to be spent on category 3 - teacher salaries. On the other hand, for the high budget configuration ($6,685), the goal programming solutions allow for the distribution of the instructional funds over categories 3 - 5. These solutions seem to validate prevailing budgetary policies. Specifically, under a temporary lean budget configuration educators tend to direct most of the resources toward instructional activities [Hartman 1985]. Also, the goal programming model calls for the allocation of a much larger amount of money to financial category 5 (cocurricular/ athletic) than the most recent allotment. This solution concurs with a recent N.J. study which showed a positive relationship between cocurricular expenditures and pupil performance.

C. Economies of Scale/Internalization of Externalities

Historically, economies of scale phenomenon has been used by firms to lower the average cost of production. In addition, enterprises have reduced their costs by "exploiting externalities" such as transportation. Apparently our goal programming solutions imply that these phenomena can not only reduce the cost, but also contribute to the enhancement of the schools' performance.

For instance, Case 1 solutions for category 20 expenditure imply that externalities (found in the surrounding area) and the size of this property poor district, for example, can be "exploited", thereby reducing its expenditure in category 20 from $456.50 to $268. In contrast, Case 3 solutions relative to the same category calls for a higher expenditure level, because the area in which the district is located lacks the necessary "externalities" needed to sustain the viability of this average district.

Finally, while the average suburban district is composed of 3,000 pupils, the findings suggest that in order to maximize the benefits of the economies of scale, a district must have 6,000-8,000 pupils. However, to maximize these benefits, each of the consolidated districts must also be endowed with the following attributes:

- an average income per return of $23,000 (per year) or more;
- a total per pupil expenditure of $4,000-$6,000;
- an average class size of 22-26 pupils;
- a pupil/teacher ratio of 16-18.

D. Summary

The findings of this study seem to confirm the prevailing notion that the quality of the scholastic outcomes produced by the schools are determined by the: a) amount of financial resources controlled by the school; b) "scholastic quality" of the pupils and their home environment; and c) quality of the socio-economic and community attributes even though they are beyond the districts' control.

In addition, the results of this applied research suggest that an efficacious resource utilization can be achieved by any type of district through the: a) application of an analytical, rather than a conventional, method to distribute the total per pupil budget over the various financial categories; and b) the exploitation of the economies of scale and externalities phenomena.

Finally, while property poor and low income districts can enhance their scholastic outcomes, this enhancement is costly. In other words, these districts must increase their expenditure per pupil at a rate which is higher than the targeted (or desired) rate of scholastic improvement. This high expenditure rate is needed to compensate the low quality of socio-economic attributes found in such districts. Although these attributes are beyond the control of the districts, they have a profound impact upon the scholastic outcomes produced by the schools. Finally, since these attributes are said to correlate with income, the districts'

average income per return was used in this study as a surrogate for these attributes.

IV. SCHOOL MANAGEMENT INFERENCES

In addition to the above findings, some management issues were inferred from the goal programming solutions, namely:

- much greater daily efforts must be devoted by management to assure the realization of the desired outcomes;
- much greater emphasis must be put on the teaching of mathematics and reading in the lower grades because of their profound influence upon the scholastic achievements of the higher school grades;
- less money should be spent on planning/research/evaluation;
- expenditures on benefits have little bearing upon the realization of the scholastic outcomes, thus they can be minimized;
- expenditures on overhead (category 20) could be minimized through the exploitation of economies of scale and externalities;
- property poor and low income districts must devote (in a long run) more funds for categories no. 9, 11 and 15 inasmuch as these categories contribute to the enhancement of the scholastic outcomes, in the long run; and finally,
- property poor and low income districts must allocate more funds to financial categories 16 and 17, thereby involving the community in the educational process.

Although this project's aim was to provide the districts with a statewide quantitative perspective, or realistic metaphor regarding the relationships between schools' resources and scholastic outcomes, some ramifications concerning state policies are briefly discussed below.

V. STATE POLICY RAMIFICATIONS

With due respect to New York State educational policies, some ramifications regarding state aid to education have been drawn from the findings. Historically, state aid to education has been intended to minimize inequalities of financial resources through the supplementation of property poor districts' budgets with financial aid. However, in light of the "nonmarket" operational environment of the schools, along with the emerging need to invest in human capital and the availability of limited state resources, modification of the current educational policy is in order. Specifically, the state aid to education policies should not only address the equity issue, but also reward improvement in the schools' scholastic performance.

In order to induce educators to pursue the state's educational mission and goals effectively, the state should monitor the spending patterns of state financial aid in terms of improved scholastic outcomes. It is recommended therefore, that the N.Y.S. Education Department should consider the implementation of administrative policies such as:

- formulate modified criteria (or formulas) for the distribution of state aid funds for alternative school's budgetary configurations;
- establish desired levels of scholastic achievement targets for various types of schools;
- review those management actions (embedded in financial category #1) which are needed to realize these state scholastic targets periodically;
- monitor schools' spending patterns in terms of the realization of the state's scholastic outcomes;
- induce schools to exploit externalities thereby minimizing their overhead costs;
- encourage schools to minimize spending on categories which have little or no influence upon the realization of the desired scholastic outcomes.

VI. RESEARCH RECOMMENDATIONS

While the methodology of this research endeavor seems to be theoretically sound, the explanatory power of this applied research approach should be enhanced. Therefore, some further work to enhance the capability of the models was suggested in this report. For instance, the intermediate logistic model can be improved by recalibrating its 28 equations through the application of Draper's centering technique.

The goal programming model, on the other hand, could be replaced and/or complemented by the compromise programming developed by Zeleny (1974), in conjunction with Saaty's (1982) technique. Also, one could explore the applicability of the Data Envelope Analysis (DEA) approach as was demonstrated by Bessent (1982).

Finally, additional areas should be explored inasmuch as the study in its current form deals with the economics of resource allocation on the school district level. For instance, the issue of individual student's test scores and their relationships to classroom resources should also be explored concurrently, as was demonstrated by Spottheim and Wilson (1984) in an earlier and related study.